How does geographical branding improve the efficiency of the apple supply chain?

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Brands are among the most valuable assets of agricultural businesses. Geographical branding can play a fundamental role in national and international markets by creating a competitive identity. On the other hand, orchard owners in a certain geographical region can understand the status of a product's supply chain. Nonetheless, few studies have focused on how branding can influence the status of a product's supply chain. Thus, the present study aimed to analyze the effect of geographical branding on improving the apple supply chain. The research is an applied study in terms of the goal, conducted by the survey methodology. Data were collected by distributing 360 questionnaires among apple orchard owners in Damavand County sampled by simple randomization. Cochran's formula estimated the sample size. The research instrument was a research-made questionnaire. Data were analyzed by structural equation modeling. According to the results, special brand value, brand loyalty, brand image, brand attitude, brand experience, brand purchasing intention, and brand identity were the components found to improve the efficiency of the Apple supply chain significantly.

KEYWORDS

apple, brand equity, brand, structural analysis, supply chain improvement

1 Introduction

Nowadays, the expansion of industrial and agricultural mass production, trading, marketing, and media has raised a need for marking products for broader markets and differentiating them in the market (Liu and Wang, 2022). Indeed, creating a commercial brand enables firms to generate a specific image of their products among consumers (Ameri Siyahooei et al., 2023). In this respect, branding has been a successful marketing approach for agricultural products, which has helped fill the gap between producers and consumers by identifying the product (Zheng et al., 2022). A successful brand can increase the product price by 5–7% in addition to promoting product quality and competitive advantage by acceptable pricing and distinction from similar products. In case of no branding, farmers' income and consumer support will be diminished (Essa and Hassen, 2022). If agricultural products cannot be differentiated in the view of consumers, the market will remain product-oriented. Consequently, it can be claimed that all products are perceived to be similar for a consumer and must be priced the same. Product brand guarantees quality improvement, increase competition between producers and retailers, endow farmers with the power of bargaining with many buyers and allow supplying branded products to customers (Ameri Siyahooei et al., 2023). In this regard, geographical branding can effectively enhance international competition

for products (Zheng et al., 2022). The term geographical brand points to the origin name and geographical indication. The origin name aims to specify that products with quality and specific features are conditioned with a geographical environment, including natural and human factors, and that they are produced, processed, and prepared completely in a certain region (a state, a region, or a location) (Uzelac et al., 2022). Indeed, geographical branding is used to identify products originating from a certain region and allow for attributing the quality, reputation, or other features of the product to its geographical or production origin (Pashova and Radev, 2021).

Various research studies have revealed that different factors influence the promotion and expansion of geographical brands, e.g., product label and shape (Pashova and Radev, 2021; Chen et al., 2023), place of sale (Uzelac et al., 2022), brand image (Mitchell and Balabanis, 2021), attitude toward brand promotion (Nayeem et al., 2019), special brand value (Niyas and Kavida, 2022), brand loyalty (Lin et al., 2019), perceived brand quality (Ray et al., 2021), attitude toward the brand (Foroudi, 2019), brand identity (Uzelac et al., 2022), and brand personality (Vi et al., 2023).

Research shows that promoting a brand and marketing agricultural products can positively improve its supply chain and the relevant components (Noori et al., 2024). For instance, Modak et al. (2024) argue that branding methods have turned into established aspects of marketing activity that can improve supply chain efficiency. Türkeş et al. (2024) found a positive and significant relationship between supply chain sustainability methods and commercial performance. They reported that commercial performance could be maximized by focusing on promoting economic, social, and environmental sustainability of the supply chain. According to Yarmand et al. (2023), focus on improving marketing strategies is vital for enhancing export performance. Furthermore, sale and marketing managers must use proper distribution channels for their export development. They must fit their product quality and packaging with customer preferences. Essa and Hassen (2022) found that branding opportunities (including enhancing efficiency for the standard production process, increasing product protection against any damage, the primary determinant of customer choice, increasing customer loyalty, fostering competition among brands, and increasing production) contributed to adhering to international standards. They also showed that the trademark of the location where the product has been made would be useful for its branding. Guo and Yin (2022) suggest that the two processes of customer services and customer relation management need the most attention as they can improve production efficiency. Mu et al. (2021) state that the influence of supply chain efficiency on marketing is inevitable. According to Pashova and Radev (2021), a significant fraction of fresh fruits and vegetables are unmarked in the Bulgarian trade network whereas the next ranks are for products with conventional production labels and bio-labels. According to Azaron et al. (2021), supply chain management is a component by which many countries try to achieve the highest level of customer satisfaction. Li et al. (2021) believe that the key to successful marketing of fresh products is to understand the supply chain and how it functions, which can optimize all links and relations. Jung et al. (2021) found it suitable to use the latest advances in remote sensing technology and to use brands for improving the flexibility of agricultural systems. Liao et al. (2021) argue that business leaders tend to adopt various advertising strategies based on their own preference for brands in order to increase supply chain performance.

Their research findings showed that investment in brand promotion was relevant to leaders' attitudes toward brands. According to Escribano et al. (2020), supply chain sustainability must be considered to make crop trademarks more attractive to consumers – especially, younger customers. Also, Gardner et al. (2019) argue that supply chain understanding is necessary not only for farmers but also for all who are involved in harvesting, packaging, and supplying crops to the market and delivering them to customers. According to Ghazinoori et al. (2020), since the market demand is changing, the Internet is mainly integrated with the supply chain, so the government needs to pay more attention to the supply chain and its stability. López-Bayón et al. (2018) also believe that the use of geographical branding as a tool plays an essential role in high-quality supply chain governance and management. Most studies have addressed five criteria of reliability, flexibility, accountability, cost, and asset as the main dimensions of the supply chain (Dissanayake and Cross, 2018; Lima-Junior and Carpinetti, 2020; Nguyen et al., 2021; Jafari et al., 2023).

Iran has a high potential for producing safe and high-quality food, but the realization of this potential requires proper marketing support based on the strategic situation and consumer perceptions during product differentiation (Ghasemi et al., 2019; Maghrebi et al., 2020). The development of specific indicators that are used to promote agricultural products' added value is important for their producers from various perspectives so that it can make use of developing agricultural product brands, strengthening consumers' trust, increasing the recognition of the region where the product originates from, protecting unfair competition, and accomplishing the market value (Sugianto et al., 2023). Apples are the third most cultivated horticultural crop after citrus and bananas (Choupannejad et al., 2018). Iran has a special place for apple production in the world thanks to its proper climatic conditions for its cultivation (Naderi et al., 2020). FAO (2020) estimated the global potato production at about 90 million tons and reported that Iran has the third rank in the apple cultivation area and the sixth rank in its production rate (3,872,000 tons) after China, Poland, Italy, the US, and Chile. About 1.5 million tons of the apples produced in Iran are exported. Apples in Iran are cultivated in an area of 296,000 ha, out of which 12,000 ha are located in Tehran province, making it the top producer in this country (Mohammadian and Niknami, 2022). Apple production, marketing, and sales account for a significant part of the local people's economy in Tehran province, especially in Damavand County (Igdir et al., 2015). Twenty types of high-quality commercial apples are harvested in this county, some with national and global fame (Godoun Malakeh, Arous, Barabaran, Jonagold, Fuji, Gala, Granny Smith, Two-Toned French, Red French, Golden Delicious, and Red Delicious), out of which about 80 percent are exported (Naderi et al., 2020).

The lack of an efficient brand in the apple production industry in Iran, especially in Damavand, is a key reason for its weak export. The export priorities have changed in the global market, so the sales market cannot be expanded by traditional trade practices (Sugianto et al., 2023). Since this has been neglected in Iran (Mehtari Arani et al., 2019), Damavand is losing its share in domestic and international markets (Azaron et al., 2021). This problem can be solved by raising awareness of the importance of brand building and promotion for exporting products, such as apples, and approaches used by top brands for survival in the global market. This research aims to analyze the effect of geographical

brands on improving the efficiency of the Apple supply chain. The specific objectives included the study of the role of Apple's brand image, attitude toward the brand, brand purchase intention, special brand value, brand personality, loyalty to the brand, brand experience, and brand identity in improving its supply chain efficiency. To achieve this goal, the following hypotheses were developed:

- H1: The Apple brand image is effective in improving the efficiency of its supply chain.
- H2: The attitude to the Apple brand is effective in improving the efficiency of its supply chain.
- H3: The intention to purchase the Apple brand is effective in improving the efficiency of its supply chain.
- H4: The Apple special brand value is effective in improving the efficiency of its supply chain.
- H5: The Apple brand personality is effective in improving the efficiency of its supply chain.
- H6: Royalty to the Apple brand is effective in improving the efficiency of its supply chain.
- H7: The Apple brand experience is effective in improving the efficiency of its supply chain.
- H8: The Apple brand identity is effective in improving the efficiency of its supply chain.

Accordingly, the conceptual model of the research was developed as depicted in Figure 1.

2 Methodology

From the perspective of research classification, this research is an applied study in terms of the goal. It also pursues effective measures to improve the efficiency of the Apple supply chain and tries to find the likely solutions for the problem. In terms of the possibility of variable control, it is quasi-experimental because the variables cannot be controlled. In addition, it is quantitative in terms of the methodology.

2.1 Study site

Damavand, the center of Damavand County, is located in Tehran province, 25 km from the southeast of Mount Damavand and 74 km from the east of Tehran City (Figure 2). Its elevation is 1960 m from the sea level, and it is fed by several rivers – one from the east originating from Lake Tar and another from the northwest originating from Mosha and Tizab, which join together to form the Damavand River. This city is located in the east of Tehran with a distance of 46 km from Iran's Capital. Based on the climatic classification, it has a cold semi-steppe climate in the middle part and a mountainous climate in the elevations. Its maximum elevation from sea level is about 2000 meters, its temperature rises to a maximum of 35°C in the summer and falls to a minimum of −20°C in the winter, and its precipitation rate is 325 mm, but higher in the elevations. In the remote past, this county was an important agricultural and animal husbandry center,
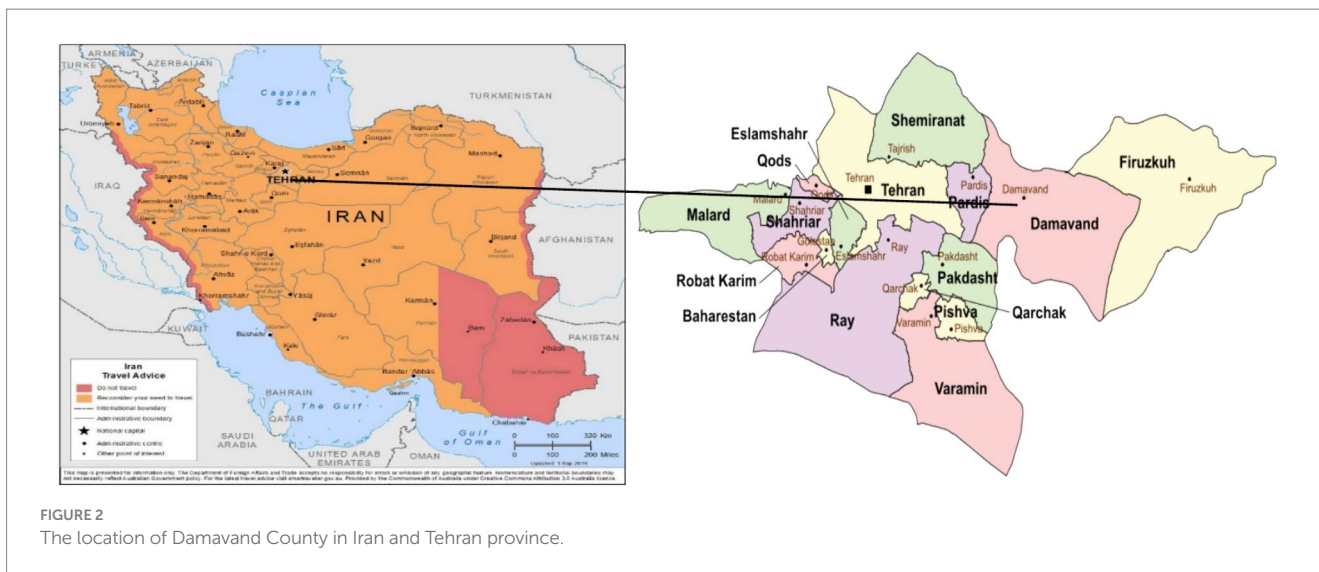

FIGURE 1
The theoretical model of the research (Source: Authors).
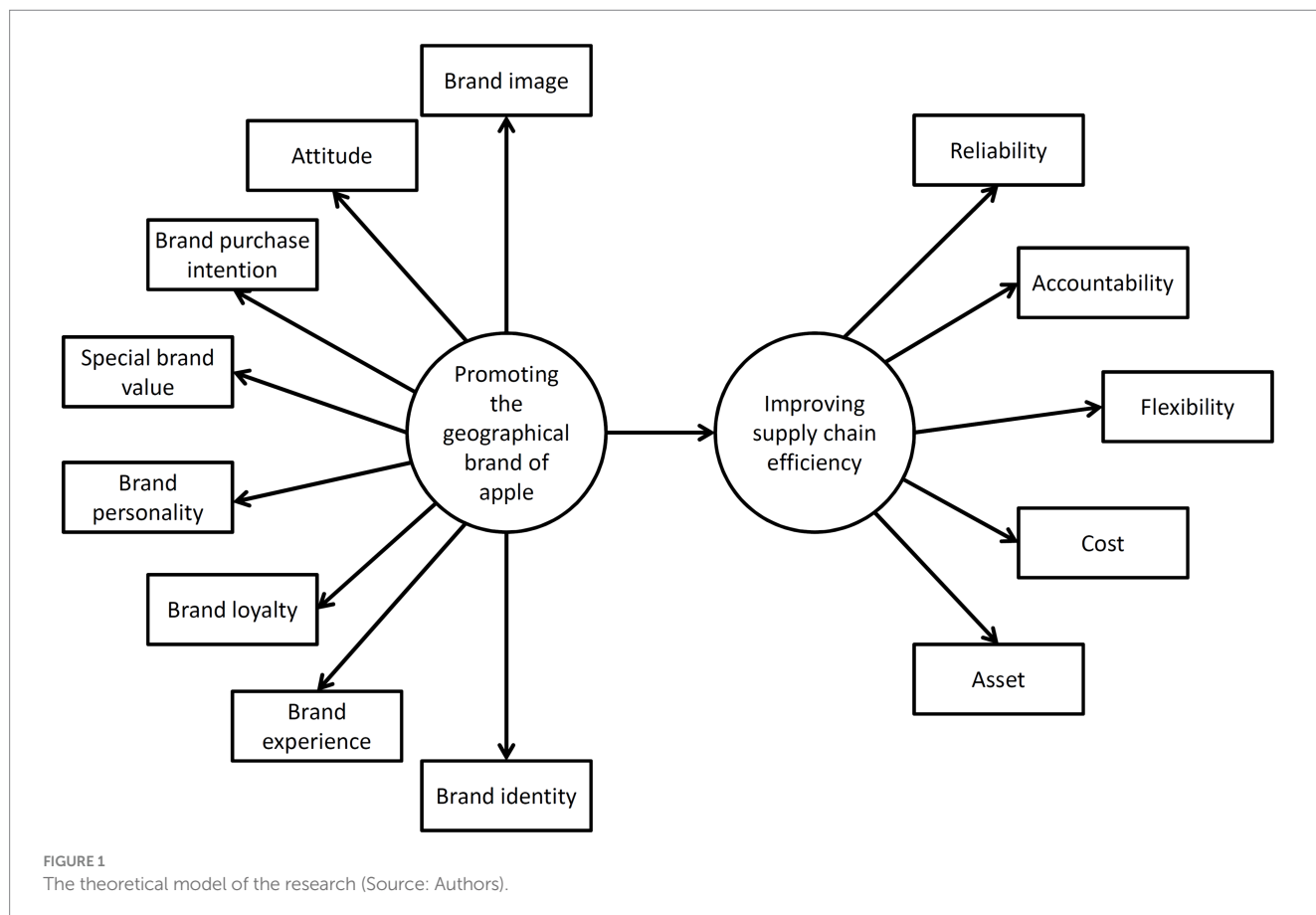
FIGURE 2
The location of Damavand County in Iran and Tehran province.

producing such products as apples, cherries, sour cherries, walnuts, potatoes, cucumbers, apricots, and other fruits and vegetables. Furthermore, it produced various animal products (Kheyroddin et al., 2017).

2.2 Statistical population and sampling method

The statistical population was composed of all apple orchard owners in Damavand County, amounting to 5,695 people. The sample size was estimated at 360 people by Cochran's formula and was taken by simple randomization.

2.3 Research instrument

To achieve the research goal, a quantitative questionnaire was designed as the main research instrument, and the data were collected using the questionnaire with a review of the literature. Based on the conceptual framework of the research, the questionnaire was composed of 13 main sections scored on a five-point Likert scale (1 = very low; 2 = low; 3 = moderate; 4 = high; 5 = very high), as well as a section for collecting data on the participants' demographic characteristics. The main sections included brand image (5 items), brand attitude (5 items), brand purchasing intention (5 items), special brand value (5 items), brand personality (5 items), brand loyalty (5 items), brand experience (5 items), brand identity (5 items), reliability (5 items), accountability (5 items), flexibility (5 items), cost (5 items), and asset (5 items). Table 1 presents the research criteria.

To check the questionnaire's validity, it was supplied to a group of research committee professors (supervisor and advisor) and sales and marketing experts and managers. After applying the revisions required, it was ensured that the questions could be used for measurement. Based on the research content and properties, the questionnaire's reliability was measured in a pilot study in which 30 questionnaires were distributed among farmers in Tehran outside the research realm to be filled out. After ensuring the validity (as confirmed by the research committee and sales and

marketing experts and managers) and reliability of the questionnaire (Cronbach's alpha in the range of 0.80–0.89) and making the required revisions, the final questionnaire was ready to use. It should be noted that some participants were not literate enough to fill out the questionnaire, so the researchers helped them in face-to-face meetings to resolve the possible ambiguities and provide explanations if required. So, the required data was collected. The validity and reliability of the final questionnaire were checked by three types of validity including content, convergent, and divergent validity, as well as reliability. The content validity, which was achieved through an opinion poll among professors, was checked to ensure the consistency of the measurement indicators and the existing literature (Hair et al., 2021). Convergent validity is based on the rationale that the indicators of each construct are correlated with one another. According to Fornell and Larcker (1981), convergent validity is said to be achieved if the average variance extracted (AVE) is greater than 0.5. Divergent validity is measured by comparing the root of AVE with the correlation of the hidden variables (Table 2). The root of AVE must be greater than the correlation of that construct with the other constructs of the research (Hair et al., 2021). The reliability in this research was checked by Cronbach's alpha and the coefficient of composite reliability (Fornell and Larcker, 1981). Cronbach's alpha was greater than the acceptable level (0.7) for all variables. Unlike Cronbach's alpha, which implies that all indicators have similar weights, composite reliability relies on the real factor loadings of each construct, so it is a better criterion of reliability. The minimum acceptable level of composite reliability to prove the construct's internal stability is 0.7 (Hair et al., 2021). Tables 2, 3 present the results about the reliability and validity of the research instrument.

According to the results and the output of the Smart PLS3 software suite in Table 2, it is evident that AVE, CR, and Cronbach's alpha are all at suitable and acceptable levels, reflecting the proper validity and reliability of the measurement instrument.

Also, Table 3 presents that the constructs are fully independent. In other words, the values in the main diagonal (the square root of AVE) for each hidden variable are greater than the correlation of that variable with the other reflective hidden

TABLE 1 The research criteria.

Criteria	Definition	References
Brand image	Brand perception is the mental linkage of a brand within the consumer's memory. A customer conjures up an image based on all the signals emitted by the brand, such as its name, product appearance, advertising, and messaging.	Helmi et al. (2022)
Attitude to brand	An individual's attitude, whether positive or negative, can influence their decision to adopt or reject a particular behavior. Essentially, the attitude towards using is the individual's favorable or unfavorable sentiment regarding the enactment of that behavior.	Helmi et al. (2022)
Brand purchase intention	It significantly impacts the ultimate behavior of product usage.	Alalwan et al. (2018)
Special brand value	Special brand value signifies the worth of a specific brand in the consumer's mind. Also, an array of assets and liabilities linked to a brand's name and symbols, which in turn affect the product's or service's value to both the company and its customers, is known as the special brand value.	Sutanto and Kussudyarsana (2024), Alalwan et al. (2018)
Brand personality	It encapsulates the anthropomorphic attributes assigned to a brand, enabling consumers to form a profound emotional bond with it.	Alalwan et al. (2018)
Brand loyalty	It represents the consumer's preference to consistently choose a specific brand over others, despite the presence of rational alternatives.	Parris and Guzman (2023)
Brand experience	It pertains to the consumer's actual experience of a product or service, beyond mere perception, and the enhancement of this experience can sway the degree of consumer contentment and fidelity.	Jingcheng et al. (2023), Parris and Guzman (2023)
Brand identity	Brand identity is composed of the brand's values, its communication style with the product, relation with audience, and essentially the same sentiment that the creator desires customers to feel during their engagement with the brand.	Jingcheng et al. (2023)
Reliability	It indicates the capability to execute tasks as anticipated.	Paramitha et al. (2023)
Responsiveness	It denotes promptness in accomplishing tasks. Responsiveness is an attribute focused on the customer and pertains to the time frame within which orders are fulfilled.	Paramitha et al. (2023), Nguyen et al. (2021)
Flexibility	Flexibility is the response to preplanned changes and demonstrates the capacity to react to external forces and the agility to modify accordingly.	Maaz and Ahmad (2022)
Cost	This characteristic encompasses the operational expenses of processes, including labor costs, transportation of raw materials, cost of goods sold, and expenses related to supply chain management.	Maaz and Ahmad (2022)
Asset	Strategies for asset management within a supply chain involve reducing inventory levels and optimizing internal operations, which are linked to the liquidity timeframe and the turnover of fixed assets.	Maaz and Ahmad (2022)

variables in the model. Thus, the research instrument is valid enough. The research data were analyzed at descriptive and inferential levels using the SPSS23 and Smart PLS3 software packages.

3 Results

The descriptive results showed that the participants were, on average, 43 years old. The education of most of them (37.45%) was at the diploma and associate degree levels. The majority of them (86.8%) were male, while females constituted only 13.2% (Table 4).

In the next step, the relationships of the variables were studied by the structural model using the PLS method, in which the T-values and the standardized estimation were included in both modes. First, to prove the research hypotheses, the Bootstrapping command was used in Smart PLS, which shows the output of t-values (Figure 3). As is seen in Figure 4, the t-values were greater than 1.96 for all main constructs, except for brand personality, which confirms the research hypotheses.

Table 5 presents the results of implementing the model in two modes of T-values and standardized estimation.

The fitness of a structural model is checked by calculating R^2 for the endogenous hidden (dependent) variables. The three values of 0.19, 0.33, and 0.67 show the thresholds of weak, moderate, and strong R^2, respectively. It was strong in this research, as is seen in Table 4. Also, Q^2 represents the model's predictivity. The Q^2 values of 0.02, 0.15, and 0.35 show that the target endogenous construct is weakly, moderately, and strongly capable of predicting the related exogenous construct or constructs, respectively (Hair et al., 2021). Table 6 proves

TABLE 2 The convergent validity and the reliability of the measurement instrument.

Variables	Average variance extract (AVE)	Composite reliability (CR)	Cronbach's alpha
Brand image	0.61	0.84	0.83
Brand attitude	0.52	0.87	0.81
Brand purchasing intention	0.64	0.84	0.80
Special brand value	0.52	0.80	0.81
Brand personality	0.61	0.83	0.84
Brand loyalty	0.53	0.85	0.78
Brand experience	0.64	0.87	0.82
Brand identity	0.58	0.80	0.84
Reliability	0.72	0.92	0.90
Accountability	0.76	0.85	0.92
Flexibility	0.61	0.88	0.84
Cost	0.60	0.88	0.83
Asset	0.60	0.88	0.83

TABLE 3 The correlation matrix and the study of divergent validity.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Brand image	0.762*												
2. Brand attitude	0.701	0.794*											
3. Brand purchasing intention	0.272	0.651	0.801*										
4. Special brand value	0.627	0.192	0.326	0.766*									
5. Brand personality	0.138	0.171	0.624	0.751	0.749*								
6. Brand loyalty	0.422	0.484	0.484	0.285	0.156	0.784*							
7. Brand experience	0.160	0.172	0.086	0.562	0.270	0.415	0.852*						
8. Brand identity	0.424	0.614	0.349	0.504	0.376	0.106	0.130	0.854*					
9. Reliability	0.484	0.351	0.154	0.264	0.312	0.624	0.670	0.754	0.884*				
10. Accountability	0.200	0.472	0.321	0.321	0.325	0.451	0.290	0.541	0.624	0.802*			
11. Flexibility	0.470	0.268	0.378	0.261	0.418	0.440	0.641	0.641	0.254	0.780	0.841*		
12. Cost	0.220	0.351	0.190	0.280	0.454	0.521	0.480	0.528	0.640	0.420	0.776	0.812*	
13. Asset	0.261	0.501	0.218	0.174	0.284	0.380	0.514	0.547	0.510	0.651	0.648	0.719	0.810

*$p < 0.05$.

the proper predictivity of the research model and confirms the suitable fitness of the structural model.

Finally, the general fitness of the model was determined by GOF, calculated by the following equation:

$$GOF = \sqrt{\overline{communalities} * \overline{R^2}}$$

Wetzels et al. (2009) suggested 0.01, 0.25, and 0.36 as the thresholds for weak, moderate, and strong GOF, respectively. It was

estimated at 0.812 in the present work, reflecting the strong fitness of the research model.

The fitness of the model was evaluated by aggregating its fit indices. Once judged, hypotheses were either supported or refuted using t-values. To test the hypotheses, the t-value was compared with +1.96 and −1.96. If it fell within this range, the hypothesis was refuted; otherwise, it was supported. Table 5 displays the results of the hypotheses testing.

The analysis of the results revealed that among the components underpinning the improvement of the supply chain efficiency, special

TABLE 4 The frequency distribution of the participants based on age, gender, and educational level.

		Frequency	Percentage	
Age	20–30 years	75	20	Mean = 43 years
	31–40 years	85	24	SD = 9.58
	41–50 years	110	30	Min = 20 years
	51–60 years	54	15	Max = 72 years
	>61 years	36	11	
	Total	360	100	
Educational level	Illiterate	36	10	Mode: bachelor's degree
	Under diploma	78	21.6	
	Diploma and associate degree	118	32.7	
	Bachelor's degree	92	25.5	
	Master's degree	30	8.3	
	Ph.D.	6	1.9	
	Total	360	100	
Gender	Female	48	13.2	Mode: male
	Male	312	86.8	
	Total	360	100	

brand value (β = 0.541; T-value = 5.854; p < 0.01) was the most effective. The subsequent ranks were for the components of brand loyalty (β = 0.484; T-value = 5.019), brand image (β = 0.545; T-value = 4.794), brand attitude (β = 0.438; T-value = 4.612), brand experience (β = 0.398; T-value = 4.168), brand purchasing intention (β = 0.327; T-value = 3.921), and brand identity (β = 0.291; T-value = 3.495), respectively (Table 7).

4 Discussion and conclusions

Marketing experts and scholars refer to the future of marketing as "the world of brand management and branding activities." A reputable brand name serves as a reliable source of information for customers who are considering purchasing a product. This reduces the risk and eventually eases the decision-making process. The research findings indicate that the variables used in the study provided a good framework for analyzing the impact of geographical (location-based) brands on enhancing the efficiency of the Apple supply chain in Iran.

As was revealed by the results, the specific brand value is effective in improving the Apple supply chain. This means that brands with higher specific values tend to have a more favorable image among customers, giving them an edge over their competitors. This will increase sales and further develop the market for the apple product. This conclusion is consistent with the findings of reports; by (Lin et al., 2021, and Le-Hoang et al., 2020).

Brand loyalty is an important factor in the efficiency of the Apple supply chain, from the perspective of the participants. Loyal customers in Iran have a clear image of the brand due to effective marketing. They recommend the brand to others, which leads to increased sales and market development. Additionally, customer loyalty helps to retain previous customers and attract new ones. Loyal customers

motivate producers and retailers to improve supply chain management to increase customer trust, which will happen through an efficient supply chain. These findings are corroborated by the results of (Lin et al., 2019; Hu et al., 2021; Tran et al., 2023).

The participants suggested the effectiveness of brand image in improving the Apple supply chain. It is crucial to create and reinforce the mental image of the brand to retain loyal customers. Brand image is the perception of the quality associated with the brand name by the customers. Many apple farmers can promote their brand image among the customers to enhance their loyalty and attract more loyal customers, ultimately leading to more profits. Similar results have been reported in (Zameer et al., 2020; Mitchell and Balabanis, 2021).

According to the participants, brand attitude can improve the Apple supply chain. People's attitudes tend to influence their behaviors towards different things, leading to various outcomes. In the meantime, there is a rather simple and set-in-stone principle: the higher the profit gained from purchasing or using a product/service, the more positive the attitude toward it becomes and the higher the willingness of the consumers to continue using it. This entails the consumers' satisfaction with the product/service and their loyalty to its supplier. This finding agrees with the results of (Rezaei et al., 2020; Chatterjee et al., 2021; Chuenban et al., 2021).

According to the participants, the brand experience can improve the Apple supply chain. When customers have a satisfying experience consuming a particular brand of agricultural products, e.g., Apples, which are directly related to their health, they are likely to re-purchase it because the brand has been successful in satisfying their requirements. This, in turn, shows the customers' loyalty to the brand since the brand holds a significant place among customers, and they will keep supporting it. This result is consistent with those reported in (Wang et al., 2022; Niknami, 2024).

The studied people expressed that the intention of customers to purchase a particular brand plays a significant role in improving the

TABLE 5 The items, factor loadings, and *T*-values for the research variables.

Variables		Items	Factor loadings	*T*-value
X1	Brand image	• Price (value) is of high importance.	0.737	23.84
X2		• Product quality is of high importance.	0.804	19.15
X3		• Orchard owners look for reliable crop yield.	0.754	24.54
X4		• There is a friendly climate in the business.	0.815	36.64
X5		• Orchard owners attach varying importance to Damavand apples according to customers' requests and requirements.	0.754	29.03
X6	Brand attitude	• The brand name of this product attracts attention.	0.846	28.44
X7		• The brand name of this product evokes emotions.	0.794	24.69
X8		• The brand name of this product is convincing.	0.845	26.54
X9		• The brand name of this product is related to my interests and needs.	0.837	23.09
X10		• The name and brand of this product is beautifully designed.	0.802	22.08
X11	Brand purchasing intention	• Based on my experience of buying Damavand apples, I may recommend them to others who ask my advice.	0.865	49.58
X12		• I would like to recommend Damavand apples to my friends and acquaintances.	0.819	35.61
X13		• I tell other people positive things about Damavand apples.	0.895	24.44
X14		• I talk about the quality of Damavand apples with my family, relatives, and friends.	0.865	20.54
X15		• I encourage other friends to buy Damavand apples.	0.827	19.14
X16	Special brand value	• The lifespan of the Damavand apple brand is long.	0.832	30.25
X17		• Products with the Damavand apple brand must have very good quality.	0.811	22.46
X18		• Damavand Apple brand adapts its services to contemporary needs and developments.	0.723	23.54
X19		• If I want a quality product, I always trust Damavand apples.	0.816	44.64
X20		• Whenever we talk about similar products, I easily and quickly remember some of the features of products with the brand name of Damavand Apple.	0.895	40.25
X21	Brand personality	• Damavand apple brand is popular with many families.	0.812	56.15
X22		• Damavand Apple products have authenticity.	0.796	40.52
X23		• Damavand Apple products are excellent compared to competitors.	0.781	56.83
X24		• Damavand apple brand proves its claims in advertisements.	0.908	32.14
X25		• Damavand apple brand offers healthy and perfect products.	0.835	42.42

(Continued)

TABLE 5 (Continued)

Variables		Items	Factor loadings	T-value
X26	Brand loyalty	• When shopping, I go to a place where I am sure it has Damavand apple brand.	0.891	41.19
X27		• In the next purchase, I will use Damavand apple brand.	0.827	36.54
X28		• If Damavand apple brand is more expensive than other brands, I will still buy it.	0.842	39.46
X29		• I consider myself loyal to products with the name and brand of Damavand apple, and if I want to buy again, I will definitely buy Damavand apples again.	0.826	31.15
X30	Brand experience	• My first choice is to buy products with the brand name of Damavand apple.	0.851	28.96
X31		• Emotionally, I am interested in Damavand apple brand.	0.894	19.56
X32		• Damavand apple brand has a great influence on my emotions.	0.812	41.54
X33		• Damavand Apple brand is an emotional brand.	0.862	23.54
X34		• I recommend the Damavand apple brand to others	0.863	39.60
X35		• Among different brands, Damavand apples have good taste, smell, and quality.	0.799	45.58
X36	Brand identity	• The personality of the Damavand apple brand is at a high level.	0.839	43.15
X37		• The culture of the Damavand apple brand is at a high level.	0.821	39.58
X38		• The reflection and association of the Damavand apple brand are at a high level.	0.872	40.15
X39		• The authenticity of Damavand apples is at a high level.	0.881	35.26
X40		• Damavand apple is a well-known brand.	0.842	31.42
X41	Reliability	• I want to continue producing Damavand apples.	0.762	30.65
X42		• I accept the risk of continuing apple production.	0.729	26.72
X43		• I am loyal to apple production and its type.	0.831	29.48
X44		• Damavand Apple brand gives me more confidence in production.	0.839	32.48
X45		• The good sale of my Apple product will help me continue this process.	0.892	24.94
X46	Accountability	• Accountability of Agricultural Jihad Organization about its responsibilities is of great importance.	0.894	23.62
X47		• Accountability of insurance against obligations is of great importance.	0.812	22.08
X48		• The accountability of the government regarding pricing is of great importance.	0.832	33.25
X49		• Accountability of the Ministry of Agriculture regarding exportation methods is very important.	0.843	31.95
X50		• The accountability of the Discretionary Punishments Organization and other organizations is of great importance in shortening the chain of dealers.	0.894	21.18

(Continued)

TABLE 5 (Continued)

| Variables		Items	Factor loadings	T-value
X51	Flexibility	• It is important to be able to increase annual production.	0.809	23.48
X52		• The increase of competitors has a positive effect on the success of orchard owners.	0.814	45.53
X53		• The ability to diversify the varieties of apples is effective in sales and its flexibility.	0.862	24.98
X54		• Maximum sales ability is of particular importance.	0.901	35.74
X55		• The ability to increase the cultivated area is effective in sales and its flexibility.	0.849	35.54
X56	Cost	• The cost of advertising and marketing is of particular importance.	0.861	31.58
X57		• The cost of inputs is of particular importance.	0.865	30.14
X58		• The cost of raw materials is of particular importance.	0.813	28.01
X59		• The cost of human resources is of particular importance.	0.912	26.83
X60		• The cost of equipment and tools is of particular importance.	0.882	27.51
X61	Asset	• The return of fixed assets is of particular importance.	0.841	30.62
X62		• Cash flow time is of particular importance.	0.837	33.65
X63		• The amount of long-term profit is of particular importance.	0.831	29.56
X64		• The amount of short-term profit is of particular importance.	0.849	25.10
X65		• The amount of capital maintenance is of particular importance.	0.769	29.69
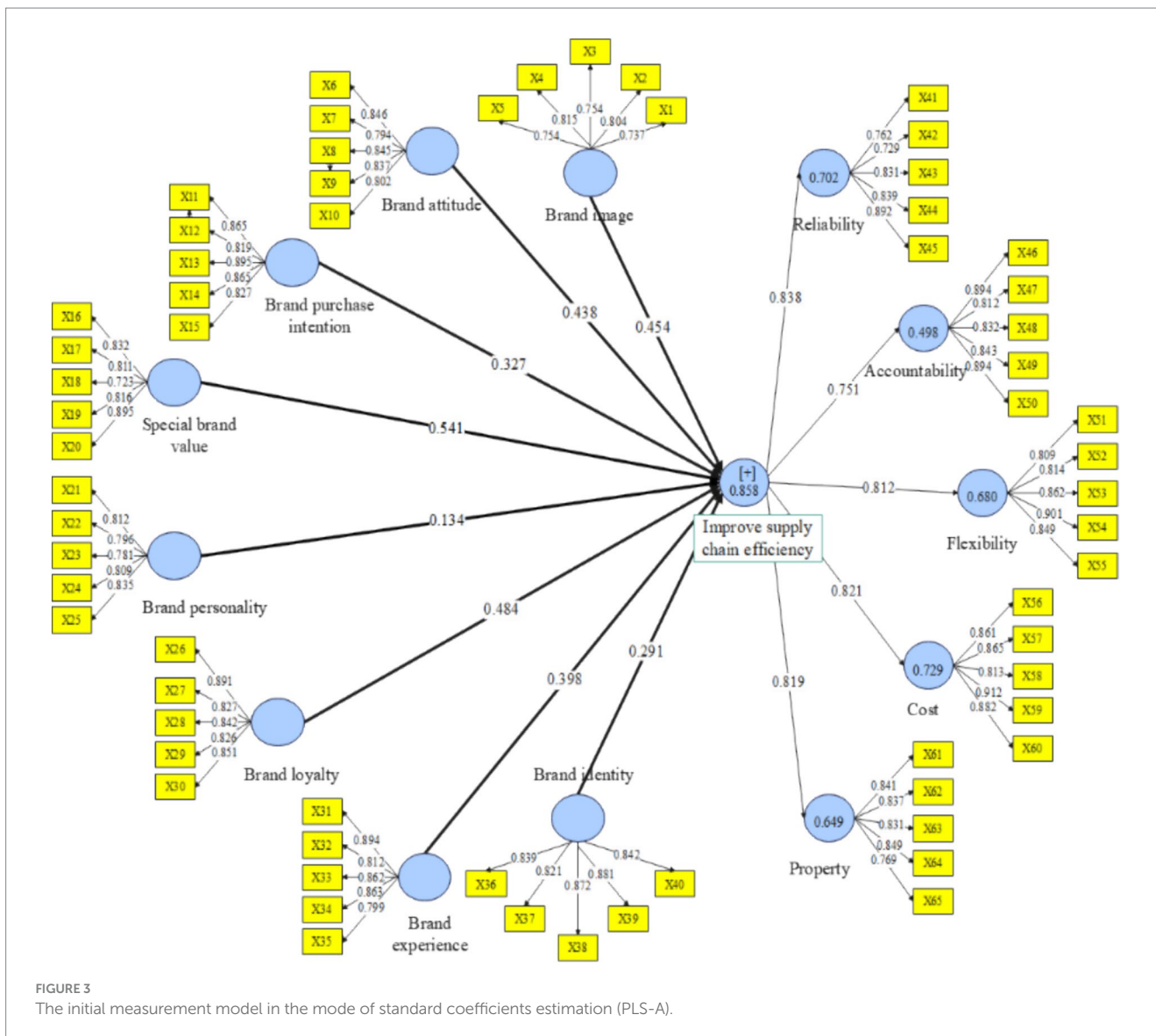
FIGURE 3
The initial measurement model in the mode of standard coefficients estimation (PLS-A).

TABLE 6 The results of R² and Q² for endogenous construct.

Hidden variables	R^2	Q^2
Improving supply chain efficiency	0.858	0.450

Apple supply chain. It means that when customers intend to purchase a product, they help the promotion of its brand and recommend it to others, too. Recommending the purchase of a brand is a sort of promotion. This increases its sales and the retailer's profit. Consequently, the retailer will decide to develop the product, thereby improving its supply chain. The intention to purchase products is directly related to the development of their market domestically and abroad. When more consumers show interest in a product, its market expands, and the need for support also increases. The need for support, in turn, improves the efficiency of the supply chain, enhances consumers' satisfaction, and increases their intention to purchase. By strengthening the supply chain, the chain of purchase, consumption,

and satisfaction is completed and repeated. This result is consistent with the reports of (Le-Hoang et al., 2020; Chi, 2021; Wang et al., 2022).

It was found that brand identity can effectively improve the Apple supply chain. Brand identity is a set of visual components, e.g., logos, colors, and details, which represent the ideas of a business and allow customers to memorize a brand and distinguish it from others. Since brand identity tries to improve product design and appearance, it is effective in improving product marketing and marketability. Improving product design needs focusing on research and development and collecting customer feedback about the product, which finally leads to developing the supply chain. Regarding the apple product, it can be said that producing and categorizing apples in different sizes can influence their marketability. On the other hand, by promoting the geographical brand, we also aim to provide the Apple product with an identity in the international dimension. Thus, to be famous at the national and international levels, a brand must have an efficient and stable supply chain to respond to customer

TABLE 7 The linear effect of the research variables for testing the research hypotheses.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T-statistic (|O/STDEV|)	p-values
• Special brand value → Apple supply chain improvement	0.541	0.691	0.084	5.854	0.000
• Brand loyalty → Apple supply chain improvement	0.484	0.477	0.13	5.019	0.000
• Brand image → Apple supply chain improvement	0.454	0.155	0.078	4.794	0.037
• Brand attitude → Apple supply chain improvement	0.438	0.389	0.095	4.612	0.000
• Brand purchasing intention → Apple supply chain improvement	0.327	0.367	0.112	3.921	0.001
• Brand identity → Apple supply chain improvement	0.291	0.391	0.077	3.495	0.000
• Brand personality → Apple supply chain improvement	0.134	0.209	0.074	1.081	0.218

needs at different levels. Similar results have been reported in (Uzelac et al., 2022; Vi et al., 2023).

Brand personality does not affect improving the Apple supply chain according to the participants. Brand personality refers to the set of characteristics that form the foundation of a business or organization and influence people's perceptions of its products, services, goals, and values. Brand personality can refer to its long-term goals in the market by providing emotional, psychological, or physical responses. It can, however, be understood that in the case of apples produced in Damavand, the use of different trademarks and improper branding have rendered brand personality irrelevant to customers. As a result, customers only consider the appearance and quality of the product and do not respond to brand names. Also, branding has been improper in this field, so the product has been supplied to the market with no brand and under a general name, leading customers to become indifferent to brand names. Similar results have been found by (Tran et al., 2023; Vi et al., 2023).

The following recommendations can be put forth based on the results: supplying apple product in unique packages to tourists and visitors to create a brand identity and proper brand value for Damavand apple at different levels; supplying high-quality product to purchasers to foster reliability in its quality; developing storage facilities to supply it in all seasons; publishing extension magazines and planning to fulfill programs tailored to apple growers' knowledge in Damavand County's local media; improving the efficiency of Damavand apple supply chain by supplying high-quality product on a timely basis and at a proper price to foster a good attitude among consumers about Damavand apple brand; and providing high-quality apple in the region to tourists to create brand experience and increasing purchase intention at the national level; advertising various products to increase consumers' purchase intention

in the national and international markets; forming extension committees to train branding at the province level and planning for developing apple branding in the region, country, and world.

The results of the research have some theoretical and practical applications. A theoretical application is to study and compare successful patterns of geographical branding of crops in the world and the secret of their success. It can be concluded at the practical level that the variables used in the research were a suitable model to analyze the effect of geographical brand on improving the apple supply chain efficiency in Iran. The researchers tried to suggest a new approach to improving the supply chain based on the causal relations of the variables, in addition to studying the promotion of a geographical brand and marketing of Apple in the previous studies.

Like other research studies, this research is not without limitations, and addressing these limitations can pave the way for future quantitative and qualitative studies. First, the statistical population was limited to apple orchard owners in Damavand. While the findings provide valuable insights for improving the efficiency of the apple supply chain, they may not apply to other agricultural products. The research results can be interpreted within the framework of the proposed model. The cross-sectional nature of the research, inability to fully control all Unwanted variables and non-generalizability of the results of this study to other areas were its other limitations.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.
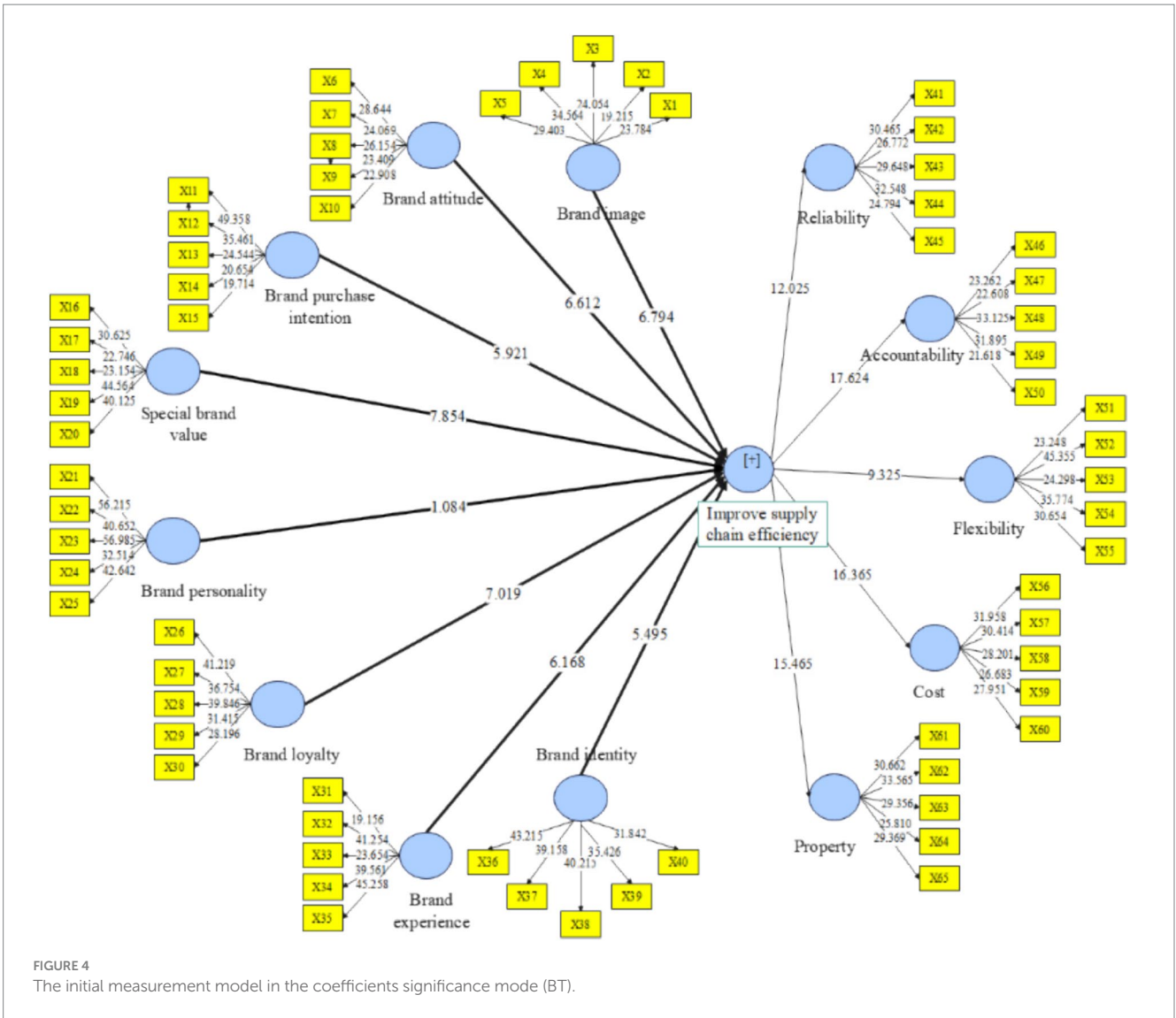
FIGURE 4
The initial measurement model in the coefficients significance mode (BT).

Ethics statement

Author contributions

SN: Conceptualization, Data curation, Formal analysis, Investigation, Software, Visualization, Writing – original draft. MN: Conceptualization, Investigation, Methodology, Resources, Supervision, Validation, Writing – review & editing. MS: Conceptualization, Methodology, Resources, Validation, Writing – review & editing. HR: Investigation, Methodology, Resources, Validation, Visualization, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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